ISAEM 2012 Conference at the Chinese Academy of Sciences, Institute of Physics, Beijing, China

1st ISAEM 2012: LV-EM research highlights

Ute A. Kaiser at the International Symposium on Advanced Electron Microscopy (ISAEM) conference 2012, Beijing, China

January, 5th-7th 2012 - At the "International Symposium on Advanced Electron Microscopy: Theory and Application" Prof. Ute A. Kaiser was invited to report on the results and prospects of the SALVE project.

The Kaiser group is well known for the work done on carbon based materials using low voltage aberration-corrected transmission electron microscopy (20-80 kV). Kaiser's talk in the topic „Aberration-Corrected Electron Microscopy", session „Physics/Materials Science" on January 5th 2012 was entitled „Transmission Electron Microscopy on Electron-Beam-Sensitive Materials at 20-80 keV — Current Status and Future Prospects".

The symposium was held at Institute of Physics, Chinese Academy of Sciences, Beijing, China and dedicated to the 80th anniversary of Prof. Fanghua Li, well known for her breakthrough contribution in the field of electron crystallography image processing technology.

The Topics of the symposium were:

— Latest Advance in Electron Microscopy
— Electron Crystallography
— Aberration-Corrected Electron Microscopy
— EM Application In Material Sciences
— Three Dimensional Electron Microscopy
— Cryo-Electron Microscopy (Tomography)

The presentation of Ute Kaiser summarized the work that has been done in collaboration of the Kaiser Group at Ulm University with ZEISS, CEOS, University of Helsinki, University of Nottingham, Technical University of Vienna and various others.

Conference abstract: ISAEM 2012 by Ute Kaiser

We demonstrate the feasibility of a ZEISS-LIBRA based imaging-side spherical aberration-corrected transmission electron microscope for direct spatial imaging and spectroscopy [1]. The transfer of the 213 pm lattice structure of single-layer graphene and of the 200-reflections (271.5 pm) of 4 nm thick Si layers are shown for an energy of 20 keV using tilted illumination [2]. At this energy radiation-sensitive fullerenes (C60) within carbon nanotubes withstand an electron dose which is about two orders of magnitude higher than at 80 keV [1]. In the spectroscopy mode we show that the monochromatic low-energy electron beam enables the acquisition of EELS spectra with exceptionally low background noise on the example of Si, Ge and InN [1], expanding previous work on low-voltage spectroscopy in the TEM [3]. Moreover, we determined the linear dispersion of graphene from momentum-resolved EELS experiments [4].

We characterize the structure and electron beam-induced dynamics of graphene and carbon nanotubes functionalized by dopants [5], defects [6], and endohedral fullerenes [7, 8]. We show that under particular irradiation conditions graphene can beget other carbon nanostructures: fullerenes [9], nano-ribbons [10], nano.-protrusions [11] and carbon nanotubes (CNT). With respect to image interpretation we show on the example of N- doped graphene that now it is possible to image the effect of charge in a HRTEM micrograph [5]. We demonstrate that HRTEM contrast at 20 keV cannot be described by

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means of the weak phase-object approximation, even for single-layer graphene, and that correction of chromatic aberration is a prerequisite for high-resolution, high-contrast low-voltage TEM imaging [12]. We give an outline of the components of the fully-corrected SALVE (Sub-Angstrom Low Voltage Electron microscope).

References:

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